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Multiple Stringency Version of MOBILE 3 Users Guide

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16. ABSTRACT

MOBILE3, as with all of the EPA mobile source models, uses a single stringency to identify the first year failure rate of TECH I (pre-catalyst) and Tech II (oxidation catalyst) vehicles in the Inspection and Maintenance (I/M) program to be modeled. This single number most often covers a wide range of technologies and vehicle classes when applied to an I/M program which inspects many model years and all vehicle types. Unless the cutpoints used are carefully balanced, the actual failure rate may vary greatly from model year to model year and vehicle class to vehicle class. This single stringency input was meant to reduce the amount of input information necessary to model an I/M scenario. It is possible for MOBILE3 to use a separate stringency for each model year of each vehicle class. The only barrier has been the need to modify the input stream and appropriate subroutines to accept and utilize user suppiled information. Such modifications have been done and the results are described in this report.

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Technical Report

Multiple Stringency Version of MOBILE3 Users Guide

By

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Technical Reports do not necessarily represent final EPA decisions or positions. They are intended to present technical analysis of issues using data which are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments which may form the basis for a final EPA decision, position or regulatory action.

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1.0 BACKGROUND

MOBILE3, as with all of the EPA mobile source models, uses a single stringency to identify the first year failure rate of Tech I (pre-catalyst) and Tech II (oxidation catalyst) vehicles in the Inspection and Maintenance (I/M) program to be modeled. This single number most often covers a wide range of technologies and vehicle classes when applied to an I/M program which inspects many model years and all vehicle types. Unless the cutpoints used are carefully balanced, the actual failure rate may vary greatly from model year to model year and vehicle class to vehicle class. This single stringency input was meant to reduce the amount of input information necessary to model an I/M scenario.

It is possible for MOBILE3 to use a separate stringency for each model year of each vehicle class. The only barrier has been the need to modifiy the input stream and appropriate subroutines to accept and utilize user supplied information.

Such modifications have now been done and the results are described in this report. No other changes in the MOBILE3 code have been made other than the changes necessary to accept the multiple stringencies. Therefore, this version of MOBILE3 is not different from the original release of MOBILE3 for non-I/M cases and differs only in its flexibility for evaluating I/M cases.

2.0 INPUTS

It is assumed for purposes of this report that the user is familiar with using MOBILE3 and has available the MOBILE3 Users Guide.* This report, therefore, addresses only the new inputs and modifications to the existing inputs.

The only input flag modified is the stringency level described in Section 2.2.3 of the MOBILER3 Users Guide. Usually the second field of the I/M characteristics record indicates the stringency to use for all model years and vehicle classes. In the Multiple Stringency MOBILE3, the use of this flag has been modified to indicate the number of stringencys the user wishes to input. The valid range for of this flag is now therefore 1 to 99.

Immediately following the I/M characteristics record in the input stream should follow the new stringency input data. This information must precede the anti-tampering program (ATP) characteristics record. The user must input stringency description records totaling the number indicated in the second field of the I/M characteristics record. Too many or too few stringency description records will result in an error message. Each stringency description record must contain the following information:

1. Vehicle class (1-3)
2. First model year of stringency group
3. Last model year of stringency group
4. Stringency (10-50)

The format for this record is I1,1X,I2,IX,I2,1X,I2.

The vehicle class indicates the vehicle type for which the stringency will apply. Only passenger cars (LDGV: 1) and light-duty trucks (LDGT1: 2 and LDGT2: 3) are valid vehicle types.

The first and last model years for the stringency group indicate inclusively the model years for which this stringency record will apply. Only the last two digits of the model year are input in each case. If the same model year is used for the first and last model year, then the stringency will only apply to that one model year. If a single stringency is to be used

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*"Users Guide to MOBILE3 (Mobile Source Emissions Model)", EPA-460/3-84-002.

for all model years of that vehicle type, the first and last model years must cover all of the model years for which stringency applies. For LDGV, this is 1951 through 1980. For LDGT1 and LDGT2, this is 1951 through 1983. Last model years beyond these ranges will cause an error message.

Model year ranges for a stringency must be chosen with care. Overlapping model year ranges for the same vehicle class will result in an error message.

Since a stringency record cannot apply to more than one vehicle type, there must be at least one stringency record for each vehicle type subject to the I/M program specified in the I/M characteristics record. If a vehicle class or model year is not given a stringency, the model will assume the stringency is zero and put a warning in the output.

The last field of the stringency record is the stringency itself. Stringency is defined as the first year failure rate in percent for the idle hydrocarbon (IHC) and idle carbon monoxide (ICO) concentration cutpoints used in the program. The stringency input in this field must correspond to the stringency for the model year group defined by the first and last model years specified in the second and third fields.

3.0 ERRORS AND WARNINGS

If a stringency record specifies an invalid (greater than 3) vehicle type, an error 84 will occur:

- out of bounds, I/M Stringency for classes 1-3 only

If a stringency record specifies a model year beyond the valid range of model years for that vehicle class, an error 85 or 86 will occur:

- inappropriate first/last MYR for stringency

If a model year is specified in more than one stringency record for a vehicle class, an error 86 will occur:

- inappropriate last MYR for stringency

This error will indicate the stringency record for the model year range whose last model year is duplicated elsewhere.

If the stringency input is not between 10 and 50, an error 33 will occur:

- out of bounds, stringency (10 to 50)

All of the above errors are fatal and will cause the MOBILE3 run to terminate.

If a vehicle class or model year covered by the I/M program which uses stringency has not had a stringency specified using a stringency record, the model will assume that the stringency is zero and will issue a warning in the output:

Warning: I/M stringency for (MYR) class ___ is zero

This warning will not prevent completion of the MOBILE3 computations.

4.0 EXAMPLE

The example input stream shows a case where nine stringencies are specified in the second field of the I/M characteristics record. The I/M characteristics record is then immediately followed by the nine stringency records. In this example three stringency records are used to define stringency levels for each of the three vehicle classes. The third stringency record demonstrates the technique to specify a stringency for a single model year. Note that the model years covered by the stringencies cover all of the model years which must be covered and do so without overlap.

The output echoes the user input stringency information in the I/M program description.

Example Input Stream for Multiple Stingency MOBILE3

```
3                                                IPROMPT
MOBILE3 : MULTIPLE STRINGENCY MOBILE3            PROJID
1 1 1 1 1 2 1 1 4 4 2 1 1                        Input/Output Flags
83 09 1 51 20 4 1 2 1                            I/M Characteristics
1 51 74 10                                       Stringency Record
1 75 79 20                                       Stringency Record
1 80 80 10                                       Stringency Record
2 51 74 10                                       Stringency Record
2 75 79 20                                       Stringency Record
2 80 83 10                                       Stringency Record
3 51 78 10                                       Stringency Record
3 79 80 20                                       Stringency Record
3 81 83 10                                       Stringency Record
1 88 19.6 75.0 20.6 27.3 20.6                    Scenario Record
```

Example Output Using Multiple Stringency MOBILE3

MOBILE3 : MULTIPLE STRINGENCY MOBILE3

I/M program selected:

Start year (January 1):	1983
Number of input stringencys:	9
Mechanic training program?:	No
First model year covered:	1951
Last model year covered:	2020
Vehicle types covered:	LDGV, LDGT1, LDGT2
1981 & later MYR test type:	Idle
1981 & later MYR test cutpoints:	1.2% ICO / 220 ppm IHC

Vehicle Class 1 - Model Years 1951 through 1974 use 10% Stringency
Vehicle Class 1 - Model Years 1975 through 1979 use 20% Stringency
Vehicle Class 1 - Model Years 1980 through 1980 use 10% Stringency
Vehicle Class 2 - Model Years 1951 through 1974 use 10% Stringency
Vehicle Class 2 - Model Years 1975 through 1979 use 20% Stringency
Vehicle Class 2 - Model Years 1980 through 1983 use 10% Stringency
Vehicle Class 3 - Model Years 1951 through 1978 use 10% Stringency
Vehicle Class 3 - Model Years 1979 through 1980 use 20% Stringency
Vehicle Class 3 - Model Years 1981 through 1983 use 10% Stringency

Total HC emission factors include evaporative HC emission factors.

Cal. Year: 1988 Region: Low Altitude: 500. Ft.
I/M Program: Yes Ambient Temp: 75.0 (F)
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6

Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Ve
Veh. Spd.:	19.6	19.6	19.6		19.6	19.6	19.6	19.6	19.6	
VMT Mix:	0.643	0.121	0.087		0.041	0.036	0.015	0.050	0.007	
Composite Emission Factors (Gm/Mile)										
Total HC:	2.25	4.15	5.14	4.57	8.75	0.40	0.62	3.94	6.02	3.02
*Evap HC:	0.85	1.33	1.74	1.50	4.60	0.0	0.0	0.0	2.26	----
Exhst CO:	14.25	26.49	28.36	27.27	91.06	1.32	1.53	11.63	19.81	19.32
Exhst NOX:	1.56	2.72	3.05	2.86	5.32	1.17	1.45	17.74	0.85	2.78

5.0 COMPUTER CODE CHANGES

The Appendix contains a listing of the subroutines and functions which contain the changes in the MOBILE3 computer code necessary to allow the use of multiple stringency. Any changes in the code are indicated by a verticle bar near the MOBILE3 Users Guide line number. The subroutines and functions with changes are:

1. Subroutine ONESEC
2. Subroutine QUITER
3. Function PCLEFT
4. Subroutine OUTIMP

Subroutine ONESEC contains the input code and input checks for the stringency records. Subroutine QUITER contains the error code output logic. Function PCLEFT chooses the appropriate stringency to use for choosing the I/M program credit for each model year of each vehicle class. This function is where the new input information is actually utilized. Subroutine OUTIMP was modified to write the user input in the MOBILE3 output.

In subroutine PCLEFT, the model sorts through all of the input stringency records for each model year of each vehicle class covered by the I/M program once for HC and once for CO. If the model year and vehicle class combination is not covered by a stringency record and that combination is covered by the I/M program as specified in the I/M characteristics record, then the stringency is assumed to be zero and PCLEFT is returned as one.

Appendix

Multiple Stringency MOBILE3 :

Computer Code Changes Necessary to Allow Multiple Stringency Input

```
3000            SUBROUTINE ONESEC(INERR,*)
3000.6    C
3000.7    C   This Subroutine has been modified to use multiple stringencies
3001      C
3002      C  ONESEC checks if control flags indicate One-time Data. It then reads in,
3003      C  validates, and stores the data.
3004      C
3005      C  Called by MAIN.
3006      C
3007      C  Calls CCEVAX, GETATP, GETIMC, GETVMT, NEWERQ, QUITER and YRTEST.
3008      C
3009      C  Input on call:
3010      C
3011      C    parameter list: INERR
3012      C    common blocks:
3013      C    /FLAGS1/ IPROMT,TAMFLG,VMFLAG
3014      C    /FLAGS2/ MYMRFG,NEWFLG,IMFLAG,ATPFLG
3015      C    /FLAGS3/ ICEVFG
3016      C    /IOUCOM/ IOUGEN,IOUASK
3017      C    /SYSCOM/ MAXVEH
3018      C    /YEARS4/ IY1941,IY1960,IY2020
3019      C
3020      C  Output on return:
3021      C
3022      C    parameter list: INERR
3023      C    common blocks:
3024      C    /BASETR/ ZMLTAM,DRTAM
3025      C    /CEVCOM/ USRTPD,USRMPD
3026      C    /IMPAR1/ ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
3027      C    /IMPAR2/ ILDT,ITEST,ICUTS,NUDATA,NLIM,IMNAME
3028      C    /MYRSAV/ AMAR,JULMYR
3029      C    /NEWCOM/ NEWPAR,BERNEW,NEWFIT,NEWCT
3030      C
3031      C  Local array subscripts:
3032      C
3033      C  NAMMMR(2,2,8)  -  NAMMMR ( ICH, IG, IV )
3034      C
3035      C  Local variable / array dictionary:
3036      C
3037      C   Name   Type              Description
3038      C  ------  ----  ------------------------------------------------------
3039      C  CHKMYR   R    myr mix check: sum of the myr fractions = 1.0 +/- 1.E-6
3040      C                (a normalized myr distribution has been entered for each IV)
3041      C  DRNEW    R    new emission rate's deterioration rate (slope)
3042      C  MYF      I    my of first (JDX order) AMAR / JULMYR to be entered on READ
3043      C  MYL      I    my of last (JDX order) AMAR / JULMYR to be entered on READ
3044      C  NAMMMR   R*8  prompts for replacement AMAR & JULMYR, by JDX & IV
3044.2    C  NVEH     I    vehicle class for stringency input
3044.4    C  NMYF     I    first model year of stringency grouping
3044.6    C  NMYL     I    last model year of stringency grouping
3044.8    C  NSTR     I    stringency for MYR/CLASS grouping
3045      C  NEWMYF   I    new emission rate's first my of affected range
3046      C  NEWMYL   I    new emission rate's last my of affected range
3047      C  NEWPOL   I    new emission rate's pollutant code
3048      C  NEWREG   I    new emission rate's region code
3049      C  NEWVEH   I    new emission rate's vehicle type code
3050      C  SUMMYR   R    sum of myr for IV; used to normalize user entered JULMYR
3051      C  ZEROML   R    user entered tampering zml to be checked: ZEROML <= 1.0
```

```
3052      C  ZMLNEW   R    new emission rate's zero mile level (intercept)
3053      C
3054      C
3055      C
3056            INTEGER TAMFLG,SPDFLG,VMFLAG,ALHFLG,ATPFLG,PRTFLG
3057            REAL JULMYR
3058      C
3059            COMMON /BASETR/ BTR(7,2),ZMLTAM(7,2,4),DRTAM(7,2,4)
3060            COMMON /CEVCOM/ USRTPD(8),USRMPD(8)
3061            COMMON /FLAGS1/ IPROMT,TAMFLG,SPDFLG,VMFLAG
3062            COMMON /FLAGS2/ MYMRFG,NEWFLG,IMFLAG,ALHFLG,ATPFLG
3063            COMMON /FLAGS3/ IFORM, PRTFLG,ICEVFG,IDLFLG,NMHFLG
3064            COMMON /IMPAR1/ ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
3065            COMMON /IMPAR2/ ILDT,ITEST,ICUTS,NUDATA,NLIM,IMNAME(20,9)
3066            COMMON /IOUCOM/ IOUAER,IOUIMD,IOUGEN,IOUREP,IOUERR,IOUASK
3067            COMMON /MYRSAV/ AMAR(20,8),JULMYR(20,8),NEWCUM
3068            COMMON /NEWCOM/ NEWPAR(5,100),BERNEW(2,100),NEWFIT(100),NEWCT
3068.5          COMMON /NEWTOO/ NEWSTR(4,100)
3069            COMMON /SYSCOM/ MAXVEH,MAXLTW,MAXPOL,MAXREG,INITPR
3070            COMMON /YEARS4/ IY1941,IY1960,IY2020
3071      C
3072            REAL*8 NAMMMR(2,2,8)
3073      C
3074            DATA NAMMMR/
3075           *   '1-10 for',' LDGV:  ',
3076           *   '11-20 fo','r LDGV: ',
3077           *   '1-10 for',' LDGT1: ',
3078           *   '11-20 fo','r LDGT1:',
3079           *   '1-10 for',' LDGT2: ',
3080           *   '11-20 fo','r LDGT2:',
3081           *   '1-10 for',' HDGV:  ',
3082           *   '11-20 fo','r HDGV: ',
3083           *   '1-10 for',' LDDV:  ',
3084           *   '11-20 fo','r LDDV: ',
3085           *   '1-10 for',' LDDT:  ',
3086           *   '11-20 fo','r LDDT: ',
3087           *   '1-10 for',' HDDV:  ',
3088           *   '11-20 fo','r HDDV: ',
3089           *   '1-10 for',' MC:    ',
3090           *   '11-20 fo','r MC:   '/
3091      C
3092      C  Process flags.
3093      C
3094            IF(TAMFLG.EQ.1) GOTO 20
3095            IF(IMFLAG.EQ.2) GOTO 10
3096      C
3097            IF(IPROMT.EQ.2) WRITE(IOUASK,200)
3098          200 FORMAT(' ','Enter tampering intercepts (zero mile levels)')
3099            IF(IPROMT.EQ.2) WRITE(IOUASK,205)
3100          205 FORMAT(' ','for non-I/M case only:')
3101            READ(IOUGEN,100,END=99)((ZMLTAM(ID,1,IVTAM),ID=1,7),IVTAM=1,4)
3102          100 FORMAT(7F8.4)
3103            IF(IPROMT.EQ.2) WRITE(IOUASK,210)
3104          210 FORMAT(' ','Enter tampering slopes (deterioration rates)')
3105            IF(IPROMT.EQ.2) WRITE(IOUASK,205)
3106            READ(IOUGEN,110,END=99)((DRTAM(ID,1,IVTAM),ID=1,7),IVTAM=1,4)
3107          110 FORMAT(7F9.5)
3108            GOTO 12
3109      C
```

```
3110          10 IF(IPROMT.EQ.2) WRITE(IOUASK,200)
3111             IF(IPROMT.EQ.2) WRITE(IOUASK,215)
3112         215 FORMAT(' ','for non-I/M and I/M cases:')
3113             READ(IOUGEN,100,END=99) ZMLTAM
3114             IF(IPROMT.EQ.2) WRITE(IOUASK,210)
3115             IF(IPROMT.EQ.2) WRITE(IOUASK,215)
3116             READ(IOUGEN,110,END=99) DRTAM
3117      C
3118      C  Insure tampering zero mile levels (intercepts) do not exceed unity.
3119      C  There is no range check for deterioration rates.
3120      C
3121          12 DO 14 IVTAM=1,4
3122             DO 14 IM=1,IMFLAG
3123             DO 14 ID=1,7
3124             ZEROML=ZMLTAM(ID,IM,IVTAM)
3125             IF(ZEROML.GT.1.0) CALL QUITER(ZEROML,0,50,INERR)
3126          14 CONTINUE
3127      C
3128      C  Check for user supplied vmt mix to be used for all scenarios of this run.
3129      C
3130          20 IF(VMFLAG.EQ.3) CALL GETVMT(INERR,&99)
3131      C
3132      C  Check for user supplied my mileage accrual rates and / or registration
3133      C  distributions.
3134      C
3135             IF(MYMRFG.EQ.1) GOTO 44
3136             IF(MYMRFG.EQ.3) GOTO 26
3137             IF(IPROMT.EQ.2) WRITE(IOUASK,220)
3138         220 FORMAT(/)
3139      C
3140             DO 22 IV=1,MAXVEH
3141             DO 22 IG=1,2
3142             IF(IPROMT.EQ.2) WRITE(IOUASK,230) (NAMMMR(ICH,IG,IV),ICH=1,2)
3143         230 FORMAT(' ','Enter MYM ages ',2A8)
3144             MYF=1
3145             IF(IG.EQ.2) MYF=11
3146             MYL=10
3147             IF(IG.EQ.2) MYL=20
3148             READ(IOUGEN,130,END=99) (AMAR(JDX,IV),JDX=MYF,MYL)
3149         130 FORMAT(10F5.3)
3150          22 CONTINUE
3151      C
3152             DO 24 IV=1,MAXVEH
3153             DO 24 JDX=1,20
3154             IF(AMAR(JDX,IV).LT.0.) CALL QUITER(AMAR(JDX,IV),0,19,INERR)
3155          24 CONTINUE
3156      C
3157             IF(MYMRFG.EQ.2) GOTO 36
3158          26 IF(IPROMT.EQ.2) WRITE(IOUASK,220)
3159             DO 32 IV=1,MAXVEH
3160             DO 28 IG=1,2
3161             IF(IPROMT.EQ.2) WRITE(IOUASK,235) (NAMMMR(ICH,IG,IV),ICH=1,2)
3162         235 FORMAT(' ','Enter MYR ages ',2A8)
3163             MYF=1
3164             IF(IG.EQ.2) MYF=11
3165             MYL=10
3166             IF(IG.EQ.2) MYL=20
3167             READ(IOUGEN,130,END=99) (JULMYR(JDX,IV),JDX=MYF,MYL)
3168          28 CONTINUE
```

```
3169     C
3170           CHKMYR=0.0
3171           DO 30 JDX=1,20
3172           CHKMYR=JULMYR(JDX,IV)+CHKMYR
3173        30 CONTINUE
3174     C
3175           IF(CHKMYR-.00001.GT.1..OR.CHKMYR+.00001.LT.1.)
3176          *  CALL QUITER(CHKMYR,0,49,INERR)
3177        32 CONTINUE
3178     C
3179           DO 34 IV=1,MAXVEH
3180           DO 34 JDX=1,20
3181           IF(JULMYR(JDX,IV).LT.0.) CALL QUITER(JULMYR(JDX,IV),0,20,INERR)
3182        34 CONTINUE
3183     C
3184     C
3185        36 DO 38 IV=1,MAXVEH
3186     C
3187     C  Skip 0 with non-0 checks if user supplies MYR only and on HDDV pass:
3188     C  the BD values are 0.0's for all 20 my's (HDDMYM has not yet been called).
3189     C
3190           IF(MYMRFG.EQ.3.AND.IV.EQ.7) GOTO 38
3191           DO 38 JDX=1,20
3192           IF(AMAR(JDX,IV).LE.0.0.AND.JULMYR(JDX,IV).GT.0.0)
3193          *    CALL QUITER(JULMYR(JDX,IV),0,21,INERR)
3194           IF(AMAR(JDX,IV).GT.0.0.AND.JULMYR(JDX,IV).EQ.0.0)
3195          *    CALL QUITER(AMAR(JDX,IV),0,22,INERR)
3196        38 CONTINUE
3197     C
3198     C  Check vehicle equalities (LDGV,LDDV), (LDGT1,LDDT) mod yr regs.
3199     C
3200           DO 40 JDX=1,20
3201           IF(JULMYR(JDX,1).NE.JULMYR(JDX,5)) CALL QUITER(0.,JDX,65,INERR)
3202           IF(JULMYR(JDX,2).NE.JULMYR(JDX,6)) CALL QUITER(0.,JDX,66,INERR)
3203        40 CONTINUE
3204     C
3205     C  Normalize JULMYR.
3206     C
3207        44 DO 50 IV=1,MAXVEH
3208     C
3209           SUMMYR=0.0
3210           DO 46 JDX=1,20
3211           SUMMYR=JULMYR(JDX,IV)+SUMMYR
3212        46 CONTINUE
3213           IF(SUMMYR.EQ.0.) SUMMYR=1.
3214     C
3215           DO 50 JDX=1,20
3216           JULMYR(JDX,IV)=JULMYR(JDX,IV)/SUMMYR
3217        50 CONTINUE
3218     C
3219     C  Here read in e.f. modification data.
3220     C
3221           IF(NEWFLG.EQ.1) GOTO 60
3222           IF(IPROMT.EQ.2) WRITE(IOUASK,240)
3223       240 FORMAT('0','Enter no. of new e.f. intercept/slope pairs (I2)')
3224           READ(IOUGEN,140,END=99) NEWCT
3225       140 FORMAT(I2)
3226           IF(NEWCT.LT.1.OR.NEWCT.GT.100) CALL QUITER(0.,NEWCT,23,INERR)
3227     C
```

```
3228            DO 55 IFAC=1,NEWCT
3229            IF(IPROMT.EQ.2) WRITE(IOUASK,250)
3230          250 FORMAT(' ','Enter region,veh. type,pollutant,first my,'/
3231           *  ' ','last my,new intercept (A), and new slope (B)')
3232            READ(IOUGEN,150,END=99) NEWREG,NEWVEH,NEWPOL,
3233           *  NEWMYF,NEWMYL,ZMLNEW,DRNEW
3234          150 FORMAT(I1,1X,I1,1X,I1,1X,I2,1X,I2,1X,F6.2,1X,F6.2)
3235            IF(NEWREG.NE.1.AND.NEWREG.NE.2)
3236           *   CALL QUITER(0.,NEWREG,62,INERR)
3237            IF(NEWVEH.LT.1.OR.NEWVEH.GT.8) CALL QUITER(0.,NEWVEH,25,INERR)
3238            IF(NEWPOL.LT.1.OR.NEWPOL.GT.3) CALL QUITER(0.,NEWPOL,26,INERR)
3239            CALL YRTEST(NEWMYF,27,IY1941,IY2020,INERR)
3240            CALL YRTEST(NEWMYL,28,IY1941,IY2020,INERR)
3241            IF(NEWMYL.LT.NEWMYF) CALL QUITER(0.,0,29,INERR)
3242            IF(ZMLNEW.LE.0.) CALL QUITER(ZMLNEW,0,30,INERR)
3243            IF(DRNEW.LT.0.) CALL QUITER(DRNEW,0,31,INERR)
3244        C
3245        C  Store alternate equation data.
3246        C
3247            NEWPAR(1,IFAC)=NEWREG
3248            NEWPAR(2,IFAC)=NEWVEH
3249            NEWPAR(3,IFAC)=NEWPOL
3250            NEWPAR(4,IFAC)=NEWMYF
3251            NEWPAR(5,IFAC)=NEWMYL
3252            BERNEW(1,IFAC)=ZMLNEW
3253            BERNEW(2,IFAC)=DRNEW
3254           55 CONTINUE
3255            CALL NEWERQ(INERR)
3256        C
3257        C  If IMFLAG=2, read in I/M program parameters.
3258        C
3259           60 IF(IMFLAG.EQ.1) GOTO 70
3260            NLIM=0
3261            IF(IPROMT.EQ.2) WRITE(IOUASK,260)
3262          260 FORMAT('0','Enter I/M Start Year, # of stringencies, m.t. flag,'/
3263           *  ' ','first model year and last model year of prog. benefits,'/
3264           *  ' ','vehicle, test type, cutpoints and newdata flags')
3265            READ(IOUGEN,160,END=99)
3266           *   ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2,ILDT,ITEST,ICUTS,NUDATA
3267          160 FORMAT(2(I2,1X),I1,1X,2(I2,1X),3(I1,1X),I1)
3268        C
3269        C  Check I/M inputs.
3270        C
3271            CALL YRTEST(ICYIM,32,IY1960,IY2020,INERR)
3272            IF(ISTRIN.LT.1) CALL QUITER(0.,ISTRIN,33,INERR)
3273            IF(IMTFLG.LT.1.OR.IMTFLG.GT.2) CALL QUITER(0.,IMTFLG,34,INERR)
3274            CALL YRTEST(MODYR1,35,IY1941,IY2020,INERR)
3275            CALL YRTEST(MODYR2,36,IY1941,IY2020,INERR)
3276            IF(MODYR1.GT.MODYR2) CALL QUITER(0.,0,37,INERR)
3277            IF(ILDT.LT.1.OR.ILDT.GT.4) CALL QUITER(0.,ILDT,72,INERR)
3278            IF(ITEST.LT.1.OR.ITEST.GT.3) CALL QUITER(0.,ITEST,73,INERR)
3279            IF(ICUTS.LT.1.OR.ICUTS.GT.3) CALL QUITER(0.,ICUTS,82,INERR)
3280            IF(NUDATA.LT.1.OR.NUDATA.GT.4) CALL QUITER(0.,NUDATA,74,INERR)
3281            IF(NUDATA.GT.1) CALL GETIMC(&99)
3281.02     C
3281.04     C   This is where the new stringencies are read.
3281.06     C
3281.08         IY1980 = 1980
3281.1          IY1983 = 1983
```

```
3281.12  C
3281.14        IF(IPROMT.EQ.2) WRITE(IOUASK,261) ISTRIN
3281.16    261 FORMAT('0','Enter for each of the ',I2,' stringencies :',/,
3281.18       *'0The vehicle type code ( 1:LDGV, 2:LDGT1, 3:LDGT2 ),',/,
3281.2        *' The first model year of the grouping,',/,
3281.22       *' The last model year of the grouping,'/,
3281.24       *' The first year failure rate (stringency).')
3281.26  C
3281.28        DO 61 IM=1,ISTRIN
3281.3         READ(IOUGEN,161,END=99) NVEH,NMYF,NMYL,NSTR
3281.32    161 FORMAT(I1,2(1X,I2),1X,I2)
3281.34  C
3281.36  C   Check the stringency input parameters
3281.38  C
3281.4         IF(NVEH.GT.3) CALL QUITER(0.,NVEH,84,INERR)
3281.42        IF(NVEH.EQ.1) CALL YRTEST(NMYF,85,IY1941,IY1980,INERR)
3281.44        IF(NVEH.GT.1) CALL YRTEST(NMYF,85,IY1941,IY1983,INERR)
3281.46        IF(NVEH.EQ.1) CALL YRTEST(NMYL,86,NMYF,IY1980,INERR)
3281.48        IF(NVEH.GT.1) CALL YRTEST(NMYL,86,NMYF,IY1983,INERR)
3281.5         IF(NSTR.LT.10.OR.NSTR.GT.50) CALL QUITER(0.,NSTR,33,INERR)
3281.52  C
3281.54  C   Store new stringency information
3281.56  C
3281.58        NEWSTR(1,IM) = NVEH
3281.6         NEWSTR(2,IM) = NMYF
3281.62        NEWSTR(3,IM) = NMYL
3281.64        NEWSTR(4,IM) = NSTR
3281.66  C
3281.68     61 CONTINUE
3281.7   C
3281.72  C   Check the MYR group ranges for overlaps
3281.74  C
3281.76        DO 62 IM=1,ISTRIN
3281.78        DO 62 IN=1,ISTRIN
3281.8         IF(NEWSTR(1,IM).NE.NEWSTR(1,IN)) GOTO 62
3281.82        IF(IM.EQ.IN)                     GOTO 62
3281.84        IF(NEWSTR(3,IM).LT.NEWSTR(2,IN)) GOTO 62
3281.86        IF(NEWSTR(3,IM).LT.NEWSTR(3,IN))
3281.88       * CALL QUITER(0.,NEWSTR(3,IM),86,INERR)
3281.9      62 CONTINUE
3281.92  C
3283     C  Anti-tampering program => get parameters and effectiveness rates.
3284     C
3285        70 IF(ATPFLG.EQ.2) CALL GETATP(INERR,&99)
3286     C
3287           IF(ICEVFG.LT.3) GOTO 90
3288     C
3289     C  Read trips/day and miles/day.
3290     C
3291           IF(IPROMT.EQ.2) WRITE(IOUASK,270)
3292       270 FORMAT('0','Enter average trips/day')
3293           READ(IOUGEN,170,END=99) USRTPD
3294       170 FORMAT(8F5.1)
3295     C
3296           DO 80 IV=1,MAXVEH
3297           IF(USRTPD(IV).LT.0.) CALL QUITER(USRTPD(IV),0,54,INERR)
3298        80 CONTINUE
3299     C
3300           IF(IPROMT.EQ.2) WRITE(IOUASK,280)
```

```
3301        280 FORMAT('0','Enter average miles/day')
3302            READ(IOUGEN,170,END=99) USRMPD
3303      C
3304            DO 85 IV=1,MAXVEH
3305            IF(USRMPD(IV).LT.0.) CALL QUITER(USRMPD(IV),0,55,INERR)
3306         85 CONTINUE
3307            CALL CCEVAX
3308         90 RETURN
3309      C
3310      C  EOF on any attempted read => take alternate return 1 => run aborts.
3311      C
3312         99 RETURN1
3313            END
```

```
11000            SUBROUTINE QUITER(RVALUE,IVALUE,MESSAG,INERR)
11000.3    C
11000.6    C   This Subroutine has been modified to use multiple stringencies
11001      C
11002      C  QUITER prints error and warning messages on unit IOUERR.
11003      C
11004      C  Called by CONSEC, CRANKC, DIURNL, EFCALX, GETATP, HOTSOK, IERPTR,
11005      C             IEXMPT, IGEPTR, IGLPTR, IGPPTR, IGSFPT, IGTPTR, IGUPTR,
11006      C             ISPPTR, ISPPT8, ITCPTR, NEWERQ, ONESEC, PARSEC, TFCALX,
11007      C             TPD, XMPD and YRTEST.
11008      C
11009      C  Input on call:
11010      C
11011      C    parameter list: RVALUE,IVALUE,MESSAG,INERR
11012      C    common blocks:
11013      C    /IOUCOM/ IOUREP,IOUERR,IOUASK
11014      C    /NEWCOM/ NEWPAR
11015      C    /NEWEQU/ MAXEQU
11016      C    /YEARS4/ IY1941,IY1960,IY2020
11017      C
11018      C  Output on return:
11019      C
11020      C    parameter list: INERR
11021      C
11022      C  Warning: there is a conditional branch to STOP at statement number 98.
11023      C
11024      C  Local array subscripts:
11025      C
11026      C  IOBMSG(5)  -  IOBMSG ( ICH )
11027      C  NAMFLG(15) -  NAMFLG ( ICH )
11028      C  NAMFNC(16) -  NAMFNC ( ICH )
11029      C  NAMVEH(8)  -  NAMVEH ( IV )
11030      C
11031      C  Local variable / array dictionary:
11032      C
11033      C   Name   Type              Description
11034      C   ------  ----  ------------------------------------------------------
11035      C  IOBMSG    I    character string vector: 'out of bounds for'
11036      C  MAXMES    I    maximum message code value ( = 83 in MOBILE3 release version)
11037      C  MCODE     I    = MESSAG = message code, unless < 0 or > MAXMES => = 1
11038      C  NAMFLG   R*8   control flag names + 'Unknown'
11039      C  NAMFNC   R*8   function names (to identify subprogram source of error)
11040      C  NAMVEH   R*8   vehicle type names
11041      C
11042      C  Notes:
11043      C
11044      C  The error message for the new function ITCPTR was installed.
11045      C  Error/warning code related to INFLAG, TRKFLG & UNFFLG removed and replaced
11046      C  with code for TAMFLG & ATPFLG.  Error code 73 refers to ITEST, not IOPTN.
11047      C  Error codes 82 (refers to ICUTS) and 83 (refers to interpolated altitude)
11048      C  added.  MAXMES accordingly was increased to 83, leaving MESSAG values
11049      C  84-97 available for future additions to QUITER's messages.
11050      C
11051      C
11052            COMMON /IOUCOM/ IOUAER,IOUIMD,IOUGEN,IOUREP,IOUERR,IOUASK
11053            COMMON /NEWCOM/ NEWPAR(5,100),BERNEW(2,100),NEWFIT(100),NEWCT
11054            COMMON /NEWEQU/ MAXEQU
11055            COMMON /YEARS4/ IY1941,IY1960,IY2020
11056      C
```

```
      DIMENSION IOBMSG(5)
C
      REAL*8 NAMFLG(15),NAMVEH(8),NAMFNC(16)
C
      DATA NAMFLG/
     *   ' Unknown',
     *   ' IPROMT ',
     *   ' TAMFLG ',
     *   ' SPDFLG ',
     *   ' VMFLAG ',
     *   ' MYMRFG ',
     *   ' NEWFLG ',
     *   ' IMFLAG ',
     *   ' ALHFLG ',
     *   ' ATPFLG ',
     *   ' IFORM  ',
     *   ' PRTFLG ',
     *   ' ICEVFG ',
     *   ' IDLFLG ',
     *   ' NHMFLG '/
C
      DATA NAMVEH/
     *   'LDGV    ',
     *   'LDGT1   ',
     *   'LDGT2   ',
     *   'HDGV    ',
     *   'LDDV    ',
     *   'LDDT    ',
     *   'HDDV    ',
     *   'MC      '/
C
      DATA NAMFNC/
     *   ' HOTSOK ',
     *   ' TPD    ',
     *   ' DIURNL ',
     *   ' XMPD   ',
     *   ' CRANKC ',
     *   ' IGEPTR ',
     *   ' IGUPTR ',
     *   ' IGLPTR ',
     *   ' IGTPTR ',
     *   ' IGPPTR ',
     *   ' IERPTR ',
     *   ' ISPPTR ',
     *   ' ISPPT8 ',
     *   ' IEXMPT ',
     *   ' ITCPTR ',
     *   ' IGSFPT '/
C
      DATA IOBMSG/
     *   '  ou','t of',' bou','nds ','for '/
C
      DATA MAXMES/86/
C
      MCODE=MESSAG
C
C  Trap unknown errors.
C
      IF(MCODE.LT.1.OR.MCODE.GT.MAXMES) MCODE=1
```

```
11116     C
11117     C  Test for warnings.
11118     C
11119           IF(MCODE.NE.16.AND.MCODE.NE.21.AND.MCODE.NE.22.AND.MCODE.NE.31
11120          *   .           .AND.MCODE.NE.49.AND.MCODE.NE.52.AND.MCODE.NE.53
11121          *               .AND.MCODE.NE.56.AND.MCODE.NE.59.AND.MCODE.NE.71)
11122          *      WRITE(IOUERR,300)
11123         300 FORMAT('-',T2,'*** Error:')
11124     C
11125     C  Branch to the appropriate error / warning message.
11126     C
11127           GOTO(
11128          *     10, 11, 11, 11, 11, 11, 11, 11, 11, 11,
11129          *     11, 11, 11, 11, 11, 16, 17, 18, 19, 20,
11130          *     21, 22, 23, 24, 25, 26, 27, 27, 29, 30,
11131          *     31, 32, 33, 34, 35, 36, 37, 38, 39, 40,
11132          *     41, 42, 43, 44, 45, 46, 47, 48, 49, 50,
11133          *     51, 52, 53, 54, 55, 56, 57, 58, 59, 60,
11134          *     61, 62, 63, 64, 65, 66, 67, 68, 69, 70,
11135          *     71, 72, 73, 74, 75, 76, 77, 78, 79, 80,
11136          *     81, 82, 83, 84, 85, 86
11137          *        ),MCODE
11138     C
11139          10 WRITE(IOUERR,310) MESSAG,NAMFLG(MCODE)
11140         310 FORMAT('+',10X,'Message code ',I4,A8)
11141             GOTO 98
11142          11 WRITE(IOUERR,311) IVALUE,IOBMSG,NAMFLG(MCODE)
11143         311 FORMAT('+',10X,I4,5A4,'flag',A8)
11144             IF(MCODE.EQ.2) WRITE(IOUERR,312)
11145         312 FORMAT(' ','Prompt/mode type (1 to 4) must be corrected before',
11146            *       ' your next run.')
11147             GOTO 98
11148          16 WRITE(IOUERR,316) RVALUE
11149         316 FORMAT(' ','Warning: ',G10.3,' speed reduced to 55 m.p.h.',
11150            *  ' maximum')
11151             GOTO 99
11152          17 WRITE(IOUERR,317) RVALUE,IOBMSG
11153         317 FORMAT('+',10X,G10.3,5A4,'VMTMIX (0. to 1.)')
11154             GOTO 98
11155          18 WRITE(IOUERR,318) RVALUE
11156         318 FORMAT('+',10X,G10.3,' sum of VMTMIX is not equal to 1.')
11157             GOTO 98
11158          19 WRITE(IOUERR,319) RVALUE
11159         319 FORMAT('+',10X,G10.3,' negative model year mileage')
11160             GOTO 98
11161          20 WRITE(IOUERR,320) RVALUE
11162         320 FORMAT('+',10X,G10.3,' negative model year registration')
11163             GOTO 98
11164          21 WRITE(IOUERR,321) RVALUE
11165         321 FORMAT(' ','Warning: ',G10.3,' registration with zero mileage')
11166             GOTO 99
11167          22 WRITE(IOUERR,322) RVALUE
11168         322 FORMAT(' ','Warning: ',G10.3,' mileage with zero registration')
11169             GOTO 99
11170          23 WRITE(IOUERR,323) IVALUE,IOBMSG
11171         323 FORMAT('+',10X,I4,5A4,'e.f. changes (1 to 100 pairs)')
11172             GOTO 98
11173          24 WRITE(IOUERR,324) IVALUE,IOBMSG
11174         324 FORMAT('+',10X,I4,5A4,'region (1,2,3 only)')
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11175          GOTO 98
11176       25 WRITE(IOUERR,325) IVALUE,IOBMSG
11177      325 FORMAT('+',10X,I4,5A4,'vehicle type (1 to 8)')
11178          GOTO 98
11179       26 WRITE(IOUERR,326) IVALUE,IOBMSG
11180      326 FORMAT('+',10X,I4,5A4,'pollutant (1 to 3)')
11181          GOTO 98
11182       27 WRITE(IOUERR,327) IVALUE,IOBMSG,IY1941,IY2020
11183      327 FORMAT('+',10X,I4,5A4,'year (',I4,' to ',I4,')')
11184          GOTO 98
11185       29 WRITE(IOUERR,329)
11186      329 FORMAT('+',10X,' last year cannot be less than first year')
11187          GOTO 98
11188       30 WRITE(IOUERR,330) RVALUE
11189      330 FORMAT('+',10X,G10.3,' intercept must be positive')
11190          GOTO 98
11191       31 WRITE(IOUERR,331) RVALUE
11192      331 FORMAT(' ','Warning: ',G10.3,' negative slope for ageing vehicle')
11193          GOTO 99
11194       32 WRITE(IOUERR,327) IVALUE,IOBMSG,IY1960,IY2020
11195          GOTO 98
11196       33 WRITE(IOUERR,333) IVALUE,IOBMSG
11197      333 FORMAT('+',10X,I4,5A4,'stringency (10 to 50)')
11198          GOTO 98
11199       34 WRITE(IOUERR,334) IVALUE,IOBMSG
11200      334 FORMAT('+',10X,I4,5A4,'mechanics training (1 to 2)')
11201          GOTO 98
11202       35 WRITE(IOUERR,335) IVALUE,IOBMSG,IY1941,IY2020
11203      335 FORMAT('+',10X,I4,5A4,'MODYR1 (',I4,' to ',I4,')')
11204          GOTO 98
11205       36 WRITE(IOUERR,336) IVALUE,IOBMSG,IY1941,IY2020
11206      336 FORMAT('+',10X,I4,5A4,'MODYR2 (',I4,' to ',I4,')')
11207          GOTO 98
11208       37 WRITE(IOUERR,337)
11209      337 FORMAT('+',10X,' MODYR1 cannot be greater than MODYR2')
11210          GOTO 98
11211       38 WRITE(IOUERR,327) IVALUE,IOBMSG,IY1960,IY2020
11212          GOTO 98
11213       39 WRITE(IOUERR,339) RVALUE
11214      339 FORMAT('+',10X,G10.3,' speed must be positive')
11215          GOTO 98
11216       40 WRITE(IOUERR,340) RVALUE
11217      340 FORMAT('+',10X,G10.3,' valid temperature is 0-110 deg. (F)')
11218          GOTO 98
11219       41 WRITE(IOUERR,341) RVALUE,IOBMSG
11220      341 FORMAT('+',10X,G10.3,5A4,'PCCN (0. to 100.)')
11221          GOTO 98
11222       42 WRITE(IOUERR,342) RVALUE,IOBMSG
11223      342 FORMAT('+',10X,G10.3,5A4,'PCHC (0. to 100.)')
11224          GOTO 98
11225       43 WRITE(IOUERR,343) RVALUE,IOBMSG
11226      343 FORMAT('+',10X,G10.3,5A4,'PCCC (0. to 100.)')
11227          GOTO 98
11228       44 WRITE(IOUERR,344) RVALUE,IOBMSG
11229      344 FORMAT('+',10X,G10.3,5A4,'AC (0. to 1.)')
11230          GOTO 98
11231       45 WRITE(IOUERR,345) RVALUE,IOBMSG
11232      345 FORMAT('+',10X,G10.3,5A4,'extra load (0. to 1.)')
11233          GOTO 98
```

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11234        46 WRITE(IOUERR,346) RVALUE,IOBMSG
11235       346 FORMAT('+',10X,G10.3,5A4,'trailers (0. to 1.)')
11236           GOTO 98
11237        47 WRITE(IOUERR,347) RVALUE,IOBMSG
11238       347 FORMAT('+',10X,G10.3,5A4,'humidity (20. to 140.)')
11239           GOTO 98
11240        48 WRITE(IOUERR,348) NAMVEH(IVALUE)
11241       348 FORMAT('+',10X,' there are no sales for vehicle ',A8)
11242           GOTO 98
11243        49 WRITE(IOUERR,349) RVALUE
11244       349 FORMAT(' ','Warning: ',G10.3,' MYR sum not = 1. (will normalize)')
11245           GOTO 99
11246        50 WRITE(IOUERR,350) RVALUE,IOBMSG
11247       350 FORMAT('+',10X,G10.3,5A4,'tampering rate intercept (up to 1.0)')
11248           GOTO 98
11249        51 WRITE(IOUERR,351) IVALUE,MAXEQU
11250       351 FORMAT('+',10X,'equation',I3,' causes more than',I3,
11251          *       ' allowed for any 1 reg/mode/pol.')
11252           GOTO 98
11253        52 WRITE(IOUERR,352) RVALUE
11254       352 FORMAT(' ','Warning: ',G10.3,' speed increased',
11255          *                          ' to 5 m.p.h. minimum')
11256           GOTO 99
11257        53 WRITE(IOUERR,353)
11258       353 FORMAT('0','You must correct all flags before you run again.')
11259           GOTO 98
11260        54 WRITE(IOUERR,354) RVALUE
11261       354 FORMAT('+',10X,G10.3,' average trips/day cannot be negative')
11262           GOTO 98
11263        55 WRITE(IOUERR,355) RVALUE
11264       355 FORMAT('+',10X,G10.3,' average miles/day cannot be negative')
11265           GOTO 98
11266        56 WRITE(IOUERR,356)
11267       356 FORMAT(' ','Comment: A/C correction factor will be calculated.'
11268          *   /' ',T11,'Value of inputted AC usage parameter is ignored.')
11269           GOTO 99
11270        57 WRITE(IOUERR,357)
11271       357 FORMAT('+',10X,'WB temp cannot be greater than DB temp')
11272           GOTO 98
11273        58 WRITE(IOUERR,358) RVALUE,IOBMSG
11274       358 FORMAT('+',10X,G10.3,5A4,'altitude (-200 to 10,000 ft.)')
11275           GOTO 98
11276        59 WRITE(IOUERR,359) IVALUE,(NEWPAR(IPAR,IVALUE),IPAR=1,3)
11277       359 FORMAT(' ','Warning: equation',I3,' zeroes all idle coefficients',
11278          *    ' (and total) for IR=',I1,', IV=',I1,', IP=',I1)
11279           GOTO 99
11280        60 WRITE(IOUERR,360) RVALUE,INERR,NAMFNC(IVALUE)
11281       360 FORMAT('+',10X,G10.3,' default used for',I5,' in function',A8)
11282           GOTO 98
11283        61 WRITE(IOUERR,361) INERR,NAMFNC(IVALUE)
11284       361 FORMAT('+',10X,' default used for',I5,' in index function',A8)
11285           GOTO 98
11286        62 WRITE(IOUERR,362) IVALUE,IOBMSG
11287       362 FORMAT('+',10X,I4,5A4,'new e.f. region (1,2,3 only)')
11288           GOTO 98
11289        63 WRITE(IOUERR,363) RVALUE,IOBMSG
11290       363 FORMAT('+',10X,G10.3,5A4,'(0. <= PCHC+PCCC <= 100.)')
11291           GOTO 98
11292        64 WRITE(IOUERR,364) RVALUE,IOBMSG
```

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11293       364 FORMAT('+',10X,G10.3,5A4,'(0. <= PCHC+PCCC-PCCN <= 100.)')
11294           GOTO 98
11295        65 WRITE(IOUERR,365) IVALUE
11296       365 FORMAT('+',10X,' MYR of LDDV not equal to LDGV for JDX=',I2)
11297           GOTO 98
11298        66 WRITE(IOUERR,366) IVALUE
11299       366 FORMAT('+',10X,' MYR of LDDT not equal to LDGT1 for JDX=',I2)
11300           GOTO 98
11301        67 WRITE(IOUERR,367) NAMVEH(IVALUE)
11302       367 FORMAT('+',10X,' EFFTP>0. and GSF=0. for vehicle ',A8)
11303           GOTO 98
11304        68 WRITE(IOUERR,368) NAMVEH(IVALUE)
11305       368 FORMAT('+',10X,' EFFTP<=0. and VMTMIX>0. for vehicle ',A8)
11306           GOTO 98
11307        69 WRITE(IOUERR,369) NAMVEH(IVALUE)
11308       369 FORMAT('+',10X,' EFIDLE>0. and GSF=0. for vehicle ',A8)
11309           GOTO 98
11310        70 WRITE(IOUERR,370) NAMVEH(IVALUE)
11311       370 FORMAT('+',10X,' EFIDLE<=0. and VMTMIX>0. for vehicle ',A8)
11312           GOTO 98
11313        71 WRITE(IOUERR,371) IOUREP,IOUERR,IOUASK
11314       371 FORMAT(' ','Comment: Current output unit numbers are',
11315          *   ' IOUREP=',I1,' IOUERR=',I1,' IOUASK=',I1)
11316           GOTO 99
11317        72 WRITE(IOUERR,372) IVALUE,IOBMSG
11318       372 FORMAT('+',10X,I4,5A4,'I/M vehicle type (1 to 4)')
11319           GOTO 98
11320        73 WRITE(IOUERR,373) IVALUE,IOBMSG
11321       373 FORMAT('+',10X,I4,5A4,'short test type flag (1 to 3)')
11322           GOTO 98
11323        74 WRITE(IOUERR,374) IVALUE,IOBMSG
11324       374 FORMAT('+',10X,I4,5A4,'new I/M data flag (1 to 4)')
11325           GOTO 98
11326        75 WRITE(IOUERR,375) IVALUE,IOBMSG
11327       375 FORMAT('+',10X,I4,5A4,'anti-tampering program start year')
11328           GOTO 98
11329        76 WRITE(IOUERR,376) IVALUE,IOBMSG
11330       376 FORMAT('+',10X,I4,5A4,'anti-tampering program 1st model year')
11331           GOTO 98
11332        77 WRITE(IOUERR,377) IVALUE,IOBMSG
11333       377 FORMAT('+',10X,I4,5A4,'anti-tampering program last model year')
11334           GOTO 98
11335        78 WRITE(IOUERR,378) IVALUE,IOBMSG
11336       378 FORMAT('+',10X,I4,5A4,'anti-tampering vehicle type (1 to 2)')
11337           GOTO 98
11338        79 WRITE(IOUERR,379) RVALUE,IOBMSG
11339       379 FORMAT('+',10X,G10.3,5A4,'evap ATP effectiveness rate (0. to 1.)')
11340           GOTO 98
11341        80 WRITE(IOUERR,380) RVALUE,IOBMSG
11342       380 FORMAT('+',10X,G10.3,5A4,'exh ATP effectiveness rate (0. to 1.)')
11343           GOTO 98
11344        81 WRITE(IOUERR,381) RVALUE,IOBMSG
11345       381 FORMAT('+',10X,G10.3,5A4,'AER matrix file column sum (0. to 1.)')
11346           GOTO 98
11347        82 WRITE(IOUERR,382) IVALUE,IOBMSG
11348       382 FORMAT('+',10X,I4,5A4,'1981+ vehicles cutpoints flag (1 to 3)')
11349           GOTO 98
11350        83 WRITE(IOUERR,383) RVALUE,IOBMSG
11351     C
```

```
11352      C  Use F, not G, format because PARSEC check of entered altitude aborts
11353      C  scenario if altitude < -200 or > 10000 feet (see QUITER message 58).
11354      C
11355        383 FORMAT('+',10X,F6.0,5A4,'altitude (region = 3 => alt. < 1500.)')
11355.1          GOTO 98
11355.2       84 WRITE(IOUERR,384) IVALUE,IOBMSG
11355.3      384 FORMAT('+',10X,I4,5A4,'I/M stringency for classes 1-3 only')
11355.4          GOTO 98
11355.5       85 WRITE(IOUERR,385) IVALUE
11355.6      385 FORMAT('+',10X,I4,' is inappropriate first MYR for stringency')
11355.7          GOTO 98
11355.8       86 WRITE(IOUERR,386) IVALUE
11355.9      386 FORMAT('+',10X,I4,' is inappropriate last MYR for stringency')
11356      C
11357      C  Messages 60 and 61 produce excessive output if not stopped here.
11358      C
11359         98 IF(MCODE.EQ.1.OR.MCODE.EQ.2.OR.MCODE.EQ.53.OR.MCODE.EQ.60
11360           *                             .OR.MCODE.EQ.61) STOP
11361            INERR=INERR+1
11362      C
11363         99 RETURN
11364            END
```

```
40000           FUNCTION PCLEFT(MY,ICY,IP,IV)
40000.09  C
40000.18  C   This Subroutine has been modified to use multiple stringencies
40000.27  C
40001     C
40002     C  PCLEFT determines the basic emission factor multiplicative adjustment
40003     C  ( = percentage left of BEF = PCLEFT ) for the effects of an inspection /
40004     C  maintanance (I/M) program, after checking whether or not I/M applies to the
40005     C  factor being computed by the calling function.
40006     C
40007     C  Called by BEF.
40008     C
40009     C  Input on call:
40010     C
40011     C    parameter list: MY,ICY,IP,IV
40012     C    common blocks:
40013     C    /FLAGS2/ IMFLAG
40014     C    /IMCR12/ CRED12
40015     C    /IMCR4P/ CRED4P
40016     C    /IMPAR1/ ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
40017     C    /IMPAR2/ ILDT,ITEST,ICUTS
40018     C
40019     C  Output on return:
40020     C
40021     C    function: PCLEFT
40022     C
40023     C  Local array subscripts:
40024     C
40025     C  MYGIM(10,3) - MYGIM ( ITECH, IVIM )
40026     C
40027     C  Local variable / array dictionary:
40028     C
40029     C   Name   Type        Description
40030     C  ------  ----  ------------------------------------------------------
40031     C  AGE1ST   I    age of the vehicle at first inspection
40032     C  BY       I    benefit year for technology 1 or 2 vehicle
40033     C  IBY      I    benefit year for technology 4 plus vehicle
40034     C  IREM     I    remainder = stringency - greatest multiple of 10 < stringency
40035     C  ISTRN    I    stringency index into technology 1 or 2 credits array
40036     C  ITECH    I    emissions control technology as f(model year, vehicle type)
40037     C  MYGIM    I    model year groups for I/M pollution control technologies
40037.5   C  NSTR     I    local stringency for MYR/CLASS grouping
40038     C  REM      R    IREM converted to REAL value
40039     C
40040     C  Notes:
40041     C
40042     C  PCLEFT has been completely rewritten.  Credits are now read in and stored
40043     C  as type REAL.  Technology IV+ modeling is changed.  For example, there are
40044     C  7 technology categories covered (4 thru 10) and IOPTN has been replaced by
40045     C  IOPTN and ICUTS.
40046     C
40047     C
40048           INTEGER ALHFLG,ATPFLG
40049     C
40050           COMMON /FLAGS2/ MYMRFG,NEWFLG,IMFLAG,ALHFLG,ATPFLG
40051           COMMON /IMCR12/ CRED12(19,20,5,2,2)
40052           COMMON /IMCR4P/ CRED4P(19,2,7,3,3)
40053           COMMON /IMPAR1/ ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
40054           COMMON /IMPAR2/ ILDT,ITEST,ICUTS,NUDATA,NLIM,IMNAME(20,9)
```

```
40054.2           COMMON /IOUCOM/ IOUAER,IOUIMD,IOUGEN,IOUREP,IOUERR,IOUASK
40054.5           COMMON /NEWTOO/ NEWSTR(4,100)
40055       C
40056             INTEGER BY,IBY,AGE1ST,MYGIM(10,3)
40057       C
40058       C  ITECH = 4 does not occur for LDGT1/2 => repeat last year (1983) of previous
40059       C  my group => value 4 will never be selected by technology search loop.
40060       C
40061             DATA MYGIM/
40062       C  ITECH: 1     2     3     4     5     6     7     8     9    10
40063       C  LDGV
40064            *  1974, 1979, 1980, 1981, 1982, 1983, 1984, 1986, 1989, 2020,
40065       C  LDGT1
40066            *  1974, 1980, 1983, 1983, 1984, 1985, 1986, 1987, 1989, 2020,
40067       C  LDGT2
40068            *  1978, 1980, 1983, 1983, 1984, 1985, 1986, 1987, 1989, 2020/
40069       C
40070       C  Initialize PCLEFT to "no reduction" value = 1.0.
40071       C
40072             PCLEFT = 1.0
40073       C
40074       C  If factor being calculated by BEF is not covered by I/M, then RETURN.
40075       C
40076             IF(IMFLAG.EQ.1.OR.IP.EQ.3.OR.IV.GT.3.OR.
40077            *  (IV.GT.1.AND.ILDT.EQ.1).OR.
40078            *  (IV.EQ.3.AND.ILDT.EQ.2).OR.
40079            *  (IV.EQ.2.AND.ILDT.EQ.3).OR.
40080            *   ICY.EQ.MY.OR.ICY.LE.ICYIM.OR.
40081            *   MY.LT.MODYR1.OR.MY.GT.MODYR2) GOTO 99
40082       C
40083       C  Find the benefit year:
40084       C
40085             BY=ICY-ICYIM
40086             IF(MY.GT.ICYIM) BY=ICY-MY
40087             IF(BY.GT.19) BY=19
40088       C
40089       C  Find the age of the vehicle at first inspection.
40090       C
40091             AGE1ST=1
40092             IF(MY.LT.ICYIM) AGE1ST=ICYIM-MY+1
40093       C
40094       C  Determine technology by model year and vehicle type.  Note that because
40095       C  MYGIM(10,IV) = 2020 for IV=1,2,3 = ICY upper bound (see PARSEC), a match in
40096       C  the technology serch loop has to occur.  As with all the my index arrays in
40097       C  MOBILE3, insure in any my changes that 2020 remains a my group upper bound.
40098       C
40099             DO 10 ITECH=1,10
40100             IF(MY.LE.MYGIM(ITECH,IV)) GOTO 20
40101          10 CONTINUE
40102       C
40103       C  Technology 3 does not exist as a separate category in the credits arrays.
40104       C  The percent reduction for technology 3 = that for technology 2.
40105       C
40106          20 IF(ITECH.EQ.3) ITECH=2
40107       C
40108       C  Select correct I/M credits for TECH 1 & 2.
40109       C  Interpolate between 10,20,30,40 & 30% stringency.
40110       C
40111             IF(ITECH.GT.2) GOTO 40
```

```
40111.05  C
40111.1   C   Determine which stringency to use for this MYR/CLASS grouping
40111.15  C
40111.2         NSTR = 0
40111.25        DO 21 IM=1,ISTRIN
40111.3         NMYF = NEWSTR(2,IM)
40111.35        NMYL = NEWSTR(3,IM)
40111.4         IF(MY.GE.NMYF.AND.
40111.45       *   MY.LE.NMYL.AND.
40111.5        *   IV.EQ.NEWSTR(1,IM)) NSTR = NEWSTR(4,IM)
40111.55     21 CONTINUE
40111.6   C
40111.65  C   Check for missing stringencies
40111.7   C
40111.75        IF(NSTR.LE.0.AND.IP.EQ.1) WRITE(IOUERR,121) MY,IV,NSTR
40111.8    121 FORMAT(' Warning: I/M stringency for ',I4,' class ',I1,' = ',I2)
40111.85        IF(NSTR.LT.10) GOTO 99
40111.9   C
40113        22 IREM=NSTR-(NSTR/10)*10
40114           REM=IREM*.1
40115           ISTRN=(NSTR-IREM)/10
40116     C
40117     C  Without mechanic training
40118     C
40119           IF(IMTFLG.EQ.2) GOTO 30
40120           PCRED=CRED12(BY,AGE1ST,ISTRN,ITECH,IP)
40121           IF(ISTRN.LT.5.AND.IREM.GT.0) PCRED=
40122          *  (CRED12(BY,AGE1ST,ISTRN+1,ITECH,IP)-PCRED)*REM+PCRED
40123           GOTO 50
40124     C
40125     C  With mechanic training
40126     C
40127        30 PCRED=CRED12(20-BY,21-AGE1ST,ISTRN,ITECH,IP)
40128           IF(ISTRN.LT.5.AND.IREM.GT.0) PCRED=
40129          *  (CRED12(20-BY,21-AGE1ST,ISTRN+1,ITECH,IP)-PCRED)*REM+PCRED
40130           GOTO 50
40131     C
40132     C  Select I/M credits for TECH 4-10 vehicles.
40133     C
40134     C  ITEST = 1 : idle test
40135     C          2 : 2500 rpm idle test
40136     C          3 : loaded test
40137     C
40138     C  ICUTS = 1 : 0.5% ICO / 100 ppm IHC
40139     C          2 : 1.2% ICO / 220 ppm IHC
40140     C          3 : 3.0% ICO / 300 ppm IHC
40141     C
40142     C
40143     C  IP=1 (HC emissions)
40144     C  IP=2 (CO emissions)
40145     C
40146        40 IBY = BY + AGE1ST - 1
40147     C
40148           PCRED=CRED4P(IBY,IP,ITECH-3,ICUTS,ITEST)
40149     C
40150     C  Set I/M benefit.
40151     C
40152        50 PCLEFT = 1.0 - PCRED
40153     C
40154        99 RETURN
40155           END
```

```
62000           SUBROUTINE OUTIMP
62000.3   C
62000.6   C   This Subroutine has been modified to use multiple stringencies
62001     C
62002     C  OUTIMP prints the I/M program parameters and the alternate I/M credits
62003     C  set name, if it was entered.
62004     C
62005     C  Called by OUTHD3 and OUTHD4.
62006     C
62007     C  Input on call:
62008     C
62009     C    common blocks:
62010     C    /IMPAR1/ ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
62011     C    /IMPAR2/ ILDT,ITEST,ICUTS,NLIM,IMNAME
62012     C    /IOUCOM/ IOUREP
62013     C    /STRING/ NOYES,COMMA
62014     C
62015     C  Local array subscripts:
62016     C
62017     C  CUTCO(3)    -  CUTCO ( ICUTS )
62018     C  CUTHC(3)    -  CUTHC ( ICUTS )
62019     C  TTYPE(4,3) -  TTYPE ( ICH, ITEST )
62020     C
62021     C  Local variable / array dictionary:
62022     C
62023     C   Name    Type              Description
62024     C  ------  ----  ------------------------------------------------------
62025     C  CUTCO     R    labels for testing cuts for CO, in percents
62026     C  CUTHC     R    labels for testing cuts for HC, in ppm IHC
62027     C  ICO       I    ICO label
62028     C  LDGT      I    LDGT label
62029     C  LDGV      I    LDGV label
62030     C  ONE       R    number 1 as character
62031     C  PPMIHC    R*8  ppm IHC label
62032     C  SLASH     R    character '/'
62033     C  TTYPE     R    test type description
62034     C  TWO       R    number 2 as character
62035     C
62036     C  Notes:
62037     C
62038     C  Output formats were updated to reflect new I/M methodology, including
62039     C  replacing IOPTN with ITEST and ICUTS.
62040     C
62041     C
62042           COMMON /IMPAR1/ ICYIM,ISTRIN,IMTFLG,MODYR1,MODYR2
62043           COMMON /IMPAR2/ ILDT,ITEST,ICUTS,NUDATA,NLIM,IMNAME(20,9)
62044           COMMON /IOUCOM/ IOUAER,IOUIMD,IOUGEN,IOUREP,IOUERR,IOUASK
62044.5         COMMON /NEWTOO/ NEWSTR(4,100)
62045           COMMON /STRING/ NOYES(2),COMMA,PERIOD
62046     C
62047           DIMENSION TTYPE(4,3),CUTCO(3),CUTHC(3)
62048           REAL*8 PPMIHC
62049     C
62050           DATA LDGV,LDGT,ONE,TWO/'LDGV','LDGT','1   ','2   '/
62051           DATA TTYPE/'Idle',' ',' ',' ',
62052          2           '2500',' rpm',' / I','dle ',
62053          3           'Load','ed /',' Idl','e   '/
62054           DATA CUTCO/'0.5%','1.2%','3.0%'/,ICO/' ICO'/
62055           DATA SLASH/' /  '/
```

```
62056           DATA CUTHC/' 100',' 220',' 300'/,PPMIHC/' ppm IHC'/
62057      C
62058           WRITE(IOUREP,200)ICYIM,ISTRIN,NOYES(IMTFLG),MODYR1,MODYR2
62059         200 FORMAT('0','I/M program selected:'/
62060            *       '0','    Start year (January 1):          ',I4/
62061            *       ' ',','    Number of input stringencies:     ',I2,/
62062            *       ' ',','    Mechanic training program?:       ',A4/
62063            *       ' ',','    First model year covered:         ',I4/
62064            *       ' ',','    Last model year covered:          ',I4)
62065      C
62066           IF(ILDT.EQ.1)WRITE(IOUREP,210) LDGV
62067           IF(ILDT.EQ.2)WRITE(IOUREP,210) LDGV,COMMA,LDGT,ONE
62068           IF(ILDT.EQ.3)WRITE(IOUREP,210) LDGV,COMMA,LDGT,TWO
62069           IF(ILDT.EQ.4)WRITE(IOUREP,210) LDGV,COMMA,LDGT,ONE,COMMA,LDGT,TWO
62070         210 FORMAT(' ','    Vehicle types covered:            ',
62071            *            A4,A2,A4,A1,A2,A4,A1)
62072      C
62073           WRITE(IOUREP,220)(TTYPE(ICH,ITEST),ICH=1,4),
62074            *                CUTCO(ICUTS),ICO,SLASH,CUTHC(ICUTS),PPMIHC
62075         220 FORMAT(' ','    1981 & later MYR test type:       ',4A4/
62076            *       ' ',','    1981 & later MYR test cutpoints: ',2A4,A2,A4,A8)
62076.1    C
62076.2    C   Output of stringencies input
62076.3    C
62076.4           WRITE(IOUREP,230)
62076.5           DO 21 IM=1,ISTRIN
62076.6           WRITE(IOUREP,221) (NEWSTR(J,IM),J=1,4)
62076.7         221 FORMAT(' Vehicle Class ',I1,' - Model Years ',I4,' through ',
62076.8            *I4,' use ',I2,'% Stringency')
62076.9          21 CONTINUE
62077      C
62078           IF(NLIM.EQ.0) GOTO 99
62079           WRITE(IOUREP,230).
62080         230 FORMAT(' ')
62081           DO 10 LINES=1,NLIM
62082           WRITE(IOUREP,240)(IMNAME(N,LINES),N=1,20)
62083         240 FORMAT(' ',20A4)
62084          10 CONTINUE
62085      C
62086          99 RETURN
62087           END
```